A GEODUCK TISSUE CHEMISTRY STUDY IN PUGET SOUND, WASHINGTON

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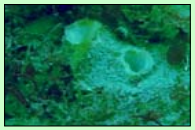


geoduck siphon

INTRODUCTION

King County is planning a new wastewater treatment facility that will require construction of a marine outfall located in the Puget Sound Central Basin. Due to the regional importance of geoducks (*Panopea abrupta*) as a commercial resource, a geoduck density and distribution survey was conducted in northern King County and southern Snohomish County between April and May 2002. To establish baseline conditions, 18 geoducks were also collected and analyzed for trace metal and organic pollutants, the results of which are presented here. See Figure 1 for study area and sampling locations.

Figure 1. Study area & sampling locations

METHODS

Geoducks were collected by SCUBA divers using a water jet. Eighteen geoducks were collected for chemical analyses, 6 in each of the 3 proposed outfall zones at depths of ~ 20, 45, and 70 ft. Two geoducks were collected at each station for whole animal and edible portion only analyses. The visceral ball and siphon skin were removed to obtain the edible portion. Table 1 shows parameters analyzed and method. Figures 2 through 5 show sample processing.

Tissue Processing Issues:

- Glass blender with titanium blades
- Ceramic knife for cutting
- Sand rinsed from siphon for edible portion
- Too large to fit in gallon jars, stored in Ziploc bags
- Too large to fit in blender whole

Figure 3. Visceral ball

Table 1

Parameters Measured	Method
Lipids (%)	Gravimetric
Solids (%)	Gravimetric
Weight (kg)	Gravimetric
Age (yr)	Univ. of Wash.
Metals (mg/Kg)	
Sb, Be, Pb, Ni, Tl, Sn	ICP-MS
As, Cd, Cr, Cu, Se, Ag, Zn	ICP-OES
Hg	CVAA
Organics	
BNAs (µg/Kg)	GC/MS
Chlorinated PCBs (µg/Kg)	GC/ECD
Chlorinated Pesticides (µg/Kg)	GC/ECD
Organophosphorus Pesticides (µg/Kg)	GC/MS (SIM)
Chlorinated Herbicides (µg/Kg)	GC/MS
Butyltins (µg/Kg)	GC/MS (SIM)

Figure 2. Processing tissue in glass blender with titantium blades to minimize metal contamination.

Figure 4. Edible portion showing amount of sand in siphon.

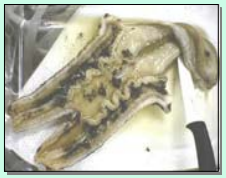


Figure 5. Edible portion showing amount of sand rinsed from the siphon and importance of rinsing sand in order to analyze for tissue concentrations only.

RESULTS

- Geoducks ranged from 9 to 95 yrs old, median age was 54 yrs.
- Have low lipids, between 0.11 and 0.74 % (mean was 0.30 %)
- No correlation between age and weight.
- 12 of 14 metals detected, no correlation with age except for mercury.
- Elevated lead concentrations detected in whole-body samples.
- Lead appears to concentrate in the visceral ball.
- Only 6 organic compounds detected: benzoic acid, benzyl alcohol, bis(2-ethylhexyl)phthalate, & 3 BHC isomers.
- There was no correlation between the BHC pesticide isomer concentrations and age and lipids.

Figure 9. Mercury concentrations compared to age

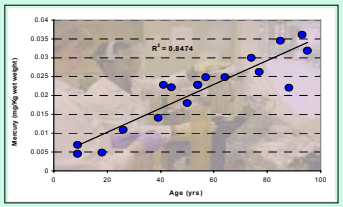


Figure 6. Metal concentrations in both whole-body and edible samples.

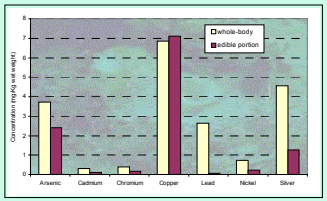


Figure 7. Lead concentrations in both whole-body and edible samples.

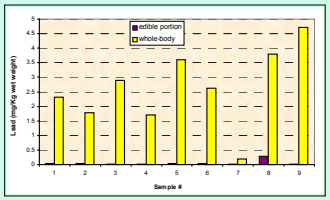
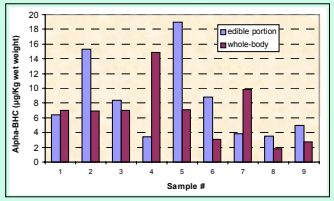


Figure 8. Alpha-BHC concentrations in both whole-body and edible samples.



CONCLUSIONS

- All attempts to achieve necessary detection limits for chlorinated herbicides did not work due to matrix interference from polar lipids, sugars, and cholesterol.
- Geoducks are concentrating 3 pesticide isomers (BHC). These same isomers were not detected in sediments or water from the same area, suggesting this organism is a useful biomonitor.
- Despite being a long-lived organism, there were no correlations detected between chemical concentrations and age, with the exception of mercury.
- Some metals, particularly lead, are concentrating in the visceral ball and metals were only detected at low concentrations in the edible portion samples.
- BHC concentrations were usually higher in the edible portion suggesting this compound is concentrating in the tissues and not the visceral ball.
- In subtidal areas, geoducks may be used to monitor metal concentrations and use is only limited by diver depth limitations.
- You feel very bad once you realize how old that geoduck was you just stuck in a blender.

GEODUCK FACTOIDS

- Pronounced "gooey-duck".
- Geoduck is Nisqually word for "dig deep".
- Largest intertidal clam in the world.
- Long-lived. Have been aged older than 146 yrs.
- Burrows up to 1 meter.
- Found intertidally up to 120 meters.

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